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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/720,851	11/24/2003	Fumikatsu Uesawa	09792909-5787	5189

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EXAMINER
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SMOOT, STEPHEN W

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 06/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/720,851	Applicant(s) UESAWA, FUMIKATSU	
	Examiner Stephen W. Smoot	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 10/154,237.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>11-24-03</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

This Office action is in response to application papers filed on 24 November 2003.

### ***Specification***

1. The disclosure is objected to because of the following informality:  
Update the first sentence of the specification to indicate that US Application Serial No. 10/154,237 has issued as US Patent No. 6,716,747.  
Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
3. Claims 5, 7-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 5, line 3, the term "can be formed" does not distinctly claim whether or not the bottom of the aperture pattern exceeds the capabilities of lithography techniques.

Claim 7 recites the limitation "said first mask material film" in line 2;

Claim 8 recites the limitation "said dielectric film" in line 2; and

Claim 9 recites the limitation "said film" in line 8.

There is insufficient antecedent basis for these limitations in claims 7-9.

### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Colacino et al. (US 4,409,319 – from applicant's IDS) as evidenced by Chow et al. (US 4,702,792 – from applicant's IDS). As best understood by the examiner, claim 5 is being interpreted to mean that the bottom of the aperture pattern does not necessarily have to exceed lithography capabilities.

Referring to Figs. 1-7, Colacino et al. disclose a process using resist masks for forming a hole in an insulator with the following features:

- A substrate (1) with metal traces (6, 7) (i.e. steps) covered with dielectric layer (4) is provided (see column 6, lines 10-25);
- Two resist layers, KMR resist layer (10) for adhesion and novolak resist layer (11), are formed over dielectric layer (4) (see Fig. 2, column 4, lines 1-5, and column 6, lines 49-59);
- Rounded and tapered via openings (i.e. apertures) are formed in the novolak resist layer (11) and this pattern is transferred to KMR resist layer (10) and dielectric layer (4) by RIE etching (see column 7, lines 30-43); and
- The remaining portions of both resist layers (10, 11) are stripped (see column 7, lines 44-47).

These are all of the limitations set forth in claims 1-3, 5 of the applicant's invention.

Regarding the low dielectric constant limitation of claim 4, the disclosure of Chow et al. indicate that silylated novolak photoresist has a dielectric constant of 3.5 (see column 10, lines 37-41). Accordingly, the novolak resist of Colacino et al. would inherently have a low dielectric constant.

6. Claims 6, 8-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Horner et al. (US 4,816,115 – from applicant's IDS).

Referring to Figs. 2-8, Horner et al. disclose a method of making via holes that includes the following features:

- A silicon nitride layer (7) formed over a silicon substrate (1) (see column 4, line 59 to column 5, line 6);

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- A polyimide insulation layer (8) spun on the silicon nitride layer (7) (see column 5, lines 6-9);
- The dielectric constant of polyimide is 3.5 (see column 4, lines 19-26);
- A photoresist layer (9) spun on the polyimide layer (8) (see column 5, lines 10-12);
- Holes with a tapered shape are formed in the photoresist layer (9) by exposure and development (see column 5, lines 31-39);
- The tapered shape of the photoresist layer (9) is transferred to the polyimide layer (8) (see column 6, lines 8-10); and
- Via holes are vertically etched into the silicon nitride layer by RIE (see column 7, lines 7-15).

These are all of the limitations set forth in claims 6, 8-9 of the applicant's invention.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horner et al. (US 4,816,115 – from applicant's IDS) as applied to claim 6 above, and further in view of Kadomura et al. (US 5,981,913 – from applicant's IDS).

As shown above, Horner et al. anticipate claim 6 of the applicant's invention. However, Horner et al. do not teach or suggest the further limitation to claim 6 set forth in claim 7 of the applicant's invention, which is to etch the mask material film with the substrate set at a temperature ranging from -50 to 0 degrees Centigrade. Kadomura et al. teach an etching apparatus that can be used for etching at temperatures below 0 degrees Centigrade. In a specific example, an overetching step is performed at -50 degrees Centigrade (see column 8, lines 62-67).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Horner et al. and Kadomura et al. in order to etch the polyimide layer of Horner et al. at a low temperature as taught by Kadomura et al. Kadomura et al. recognize that etching at low temperatures has the advantage of suppressing reaction of the sidewalls with radicals (see column 9, lines 10-23).

### ***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Teh et al. teach a method of forming a tapered opening in a dielectric layer.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00am to 4:30pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sws

*Stephen W. Smoot*  
Patent Examiner  
Art Unit 2813